

CLAIMS

1. A method of setting up a layer-structured path constructed from multiple layers of paths, comprising the steps of:

5 (a) transmitting a first message from a start-point node to an end-point node of the highest-layer path, said first message carrying a label request for a plurality of layer paths;

10 (b) mapping labels to the requested paths at each node in response to said label request;

(c) transmitting a second message from the end-point node to the start-point node of said highest-layer path in response to said first message, thereby reporting by means of said second message the labels mapped in said step (b); and

15 (d) storing said reported labels at each node.

2. A method according to claim 1, further comprising the step of (e) determining, at a start-point node of each path of each layer, whether to set up a new path or to use an already established path, after

20 receiving said first message but before sending out said first message.

3. A method according to claim 2 wherein, when it is determined in said step (e) that an already

25 established path should be used rather than setting up a new path, said first message transmitted in said first step (a) contains an instruction to use said already established path.

4. A method according to claim 2 wherein, when it is determined in said step (e) that an already

30 established path should be used rather than setting up a new path, said first message transmitted in said first step (a) is addressed to an end-point of said already established path.

35 5. A method according to claim 1, further comprising the step of (f) determining a relay point for each path of each layer at the start-point node of said

each path of each layer.

6. A method according to claim 1, further comprising the step of (f) determining relay points for all the paths at the start-point node of said highest-layer path.

7. A method according to claim 6, wherein said label request contains an instruction as to whether to permit or not to permit the use of an already established path for each path of each layer, and when the use of an already established path is permitted, and when said already established path exists, then it is determined in said step (e) that said already established path should be used.

8. A method according to claim 6, wherein said label request contains specification of a required bandwidth, and when said already established path exists, and when available bandwidth on said already established path is not smaller than said required bandwidth, then it is determined in said step (e) that said already established path should be used.

9. A method according to claim 6, wherein said label request contains specification of a required bandwidth for each path of each layer, and when said already established path exists, and when available bandwidth on said already established path is not smaller than the bandwidth specified as required for the requested path of the same layer as said already established path, then it is determined in said step (e) that said already established path should be used.

10. A method according to claim 1, wherein the label of any one of layer paths is an optical wavelength used.

11. A node apparatus for setting up a layer-structured path constructed from multiple layers of paths, comprising:

means for generating a first message which contains a label request for a plurality of layer paths, and which is transmitted to an end-point node of the highest-layer path;

5 means for transmitting said generated first message;

means for receiving a second message as a response to said first message; and

10 means for storing a label that is contained in said received second message as a response to said label request.

12. A node apparatus according to claim 11, further comprising means for determining whether to set up a new path, or to use an already established path, for a path about to be set up with its own node as a start point.

13. A node apparatus according to claim 12, wherein when said determining means determines that an already established path should be used rather than setting up a new path for the path about to be set up with its own node as the start point, said message generating means generates said first message by including therein an instruction to use said already established path.

14. A node apparatus according to claim 12 wherein, when said determining means determines that an already established path should be used rather than setting up a new path for the path about to be set up with its own node as the start point, said message generating means generates said first message by setting an end point of said already established path as an destination.

15. A node apparatus according to claim 11, further comprising means for determining a relay point only for the path about to be set up with its own node as the start point.

16. A node apparatus according to claim 11, further comprising means for determining relay points for all the paths of all the layers.

17. A node apparatus according to claim 16, wherein

said label request contains a specification as to whether to permit or not to permit the use of an already established path for each path of each layer.

5       18. A node apparatus according to claim 16, wherein said label request contains specification of a required bandwidth.

19. A node apparatus according to claim 16, wherein said label request contains specification of a required bandwidth for each path of each layer.

10       20. A node apparatus according to claim 11, wherein the label of any one of layer paths is an optical wavelength used.

15       21. A node apparatus for setting up a layer-structured path constructed from multiple layers of paths, comprising:

20               means for receiving and then transmitting a first message that contains a label request for a plurality of layer paths, and that is being transferred from a start-point node to an end-point node of the highest-layer path;

              means for mapping labels to the requested paths in response to said label request;

25               means for receiving a second message as a response to said first message, and for transmitting said second message by including therein the labels mapped by said mapping means; and

              means for storing the labels contained in said received second message.

30       22. A node apparatus according to claim 21, further comprising means for determining whether to set up a new path, or to use an already established path, for a path about to be set up with its own node as a start point, said determination being made after receiving said first message but before sending out said first message.

35       23. A node apparatus according to claim 22, wherein when said determining means determines that an already established path should be used rather than setting up a

new path for the path about to be set up with its own  
node as the start point, said first message  
receiving/transmitting means transmits said first message  
by including therein an instruction to use said already  
5 established path.

24. A node apparatus according to claim 22, wherein  
when said determining means determines that an already  
established path should be used rather than setting up a  
new path for the path about to be set up with its own  
10 node as the start point, said first message  
receiving/transmitting means transmits said first message  
by setting an end point of said already established path  
as an destination.

25. A node apparatus according to claim 21, further  
15 comprising means for determining a relay point for the  
path about to be set up with its own node as the start  
point.

26. A node apparatus according to claim 21, wherein  
20 relay points for all the paths of all the layers are  
determined at the start-point node of the highest-layer  
path.

27. A node apparatus according to claim 26, wherein  
said label request contains an instruction  
as to whether to permit or not to permit the use of an  
25 already established path for each path of each layer, and  
when the use of an already established  
path is permitted, and when said already established path  
exists, then said determining means determines that said  
already established path should be used.

28. A node apparatus according to claim 26, wherein  
30 said label request contains specification  
of a required bandwidth, and  
when said already established path exists,  
and when available bandwidth on said already established  
35 path is not smaller than said required bandwidth, then  
said determining means determines that said already  
established path should be used.

5                   when said already established path exists,  
and when available bandwidth on said already established  
path is not smaller than the bandwidth specified as  
required for the requested path of the same layer as said  
already established path, then said determining means  
10 determines that said already established path should be  
used.

15           31. A node apparatus for setting up a layer-  
structured path constructed from multiple layers of  
paths, comprising:

means for receiving a first message that  
is transmitted from a start-point node of the highest-  
20 layer path, and that contains a label request for a  
plurality of layer paths;

means for mapping labels to the requested paths in response to said label request; and

means for transmitting in response to said  
25 first message a second message containing therein the  
labels mapped by said mapping means.

32. A node apparatus according to claim 31, wherein the label of any one of layer paths is an optical wavelength used.